



## Montana Greater Sage-grouse Population Report

September 12, 2018

Montana Greater Sage-grouse population estimates and associated uncertainty, and the number of known breeding sites (called leks) are presented here in compliance with MCA 87-1-201(1)(11), as amended in 2017.

### Population Estimates

Montana Fish, Wildlife and Parks (FWP) worked with Dr. Paul Lukacs, University of Montana, to estimate sage-grouse population numbers based on counts of displaying males at leks using *N*-mixture models (Fig. 1, Table 1). This modeling approach is a robust analytical method for estimating population size and trend over time for species like sage-grouse that congregate at discrete breeding sites (McCaffrey et al. 2016). Although FWP maintains a database of male counts at leks that date back to 1952, only data from 2002 onward could be used with this modeling approach.

### *Some Caveats...*

All models are an approximation, not truth, and rely on certain assumptions. The assumptions that were made in the development of these population estimates include:

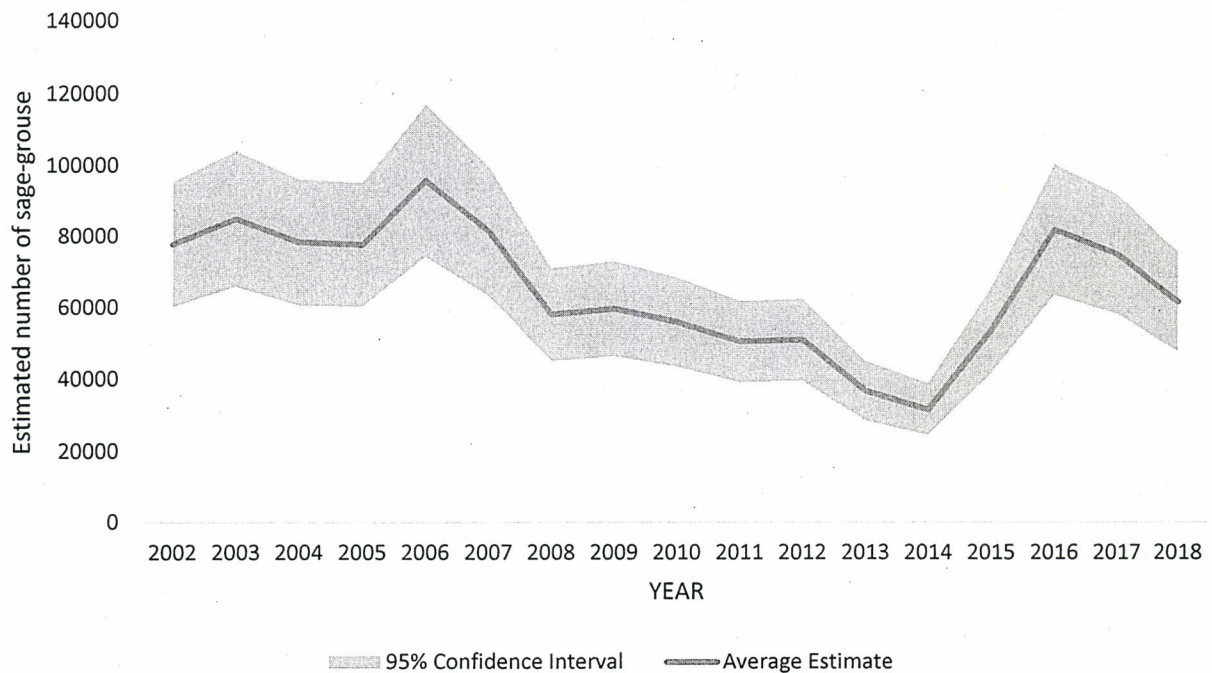
- FWP does not count females but can estimate the number of females based on an assumed sex ratio. We used an average ratio of 2.45:1 females to males based on published literature (Taylor et al. 2011). True population numbers may be larger or smaller than estimated depending upon the actual ratio in each year
- Only data from known leks were used in the calculations. This could lead to under-estimating the true population if there were a sizeable number of unknown leks.
- Models assumed each male visited one lek. This could lead to over-estimating the true population if individual males visited and were counted at multiple leks.
- Models assumed each male was detected independently. This could lead to under-estimating the true population if detection of some individuals was dependent upon detection of other individuals.

It is also important to recognize these models use algorithms that will estimate similar, but not precisely the same, population numbers each time the models are run. This means that population estimates may vary slightly from the previous report but are well within reported confidence limit bounds.

Sage-grouse population numbers oscillate over a period of 8 – 10 years across large scales (Fedy and Doherty 2011). The lower numbers estimated for Montana's population in the years 2008 – 2014 relative to preceding or subsequent years are likely due, in part, to natural population fluctuations. It is not appropriate to make decisions based on estimates from a single or few years without putting them in the context of a longer timeframe.

There are other analytical models that have utility for estimating population size and trends, such as Integrated Population Models. However, these models require additional demographic information, such as recruitment data, that are currently unavailable statewide. FWP may explore additional modeling techniques in the future as new data become available.

## Montana Sage-grouse Population Estimates 2002 - 2018



**Figure 1.** Graphical representation of Greater Sage-grouse population estimates and associated uncertainty from *N*-mixture models in Montana, 2002 – 2018. In general terms, confidence intervals are the range of values that describe the uncertainty around the population estimate.

**Table 1.** Numerical estimates of Greater Sage-grouse population numbers and associated uncertainty from *N*-mixture models in Montana, 2002-2018.

Year	Population Estimate	Standard Error	Confidence Interval	
			Lower Bound	Upper Bound
2002	77621	8981	60019	95224
2003	84770	9746	65668	103873
2004	78180	9063	60417	95943
2005	77422	8893	59992	94852
2006	95473	10938	74034	116912
2007	81280	9298	63055	99505
2008	57790	6639	44778	70803
2009	59422	6823	46050	72794
2010	55672	6386	43156	68188
2011	50204	5808	38820	61587
2012	50651	5831	39222	62080
2013	36535	4202	28298	44771
2014	31383	3633	24263	38504
2015	53336	6120	41342	65331
2016	81527	9371	63160	99894
2017	74581	8545	57833	91329
2018	61251	7098	47338	75164



## Number of Leks

FWP maintains a spatial database of Greater Sage-grouse leks, summarized by activity status in Table 2. FWP staff are continually working to confirm and record new lek locations and update lek status. In 2018, FWP added a new status category, *Provisionally Active*, to alert the Montana Sage Grouse Habitat Conservation Program, the Bureau of Land Management, and industry proponents of newly discovered leks immediately. Two survey years are required to meet the definition of a Confirmed Active lek; thus, without a Provisionally Active status option, there was a delay of over one year before resource agencies and industry were notified of newly discovered leks. Provisionally Active status is meant to be temporary. If data are not sufficient to meet the definition of Confirmed Active after a second year of surveys, a Provisionally Active lek will revert to Unconfirmed and would not be evaluated under state or federal assessments for new development. If data is sufficient in the second year of surveys, the lek will immediately be classified as Confirmed Active.

**Table 2.** Number of known Greater Sage-grouse leks in Montana by classification status, 2002 – 2018.\*

Year	Confirmed Active	Confirmed Inactive	Confirmed Extirpated	Provisionally Active^	Never Confirmed Active	Unconfirmed	Total
2002	548	79	17	.	29	514	1187
2003	613	84	17	.	47	521	1282
2004	650	88	19	.	56	532	1345
2005	675	94	19	.	64	545	1397
2006	718	96	19	.	67	605	1505
2007	753	98	20	.	72	631	1574
2008	809	100	22	.	75	592	1598
2009	851	104	25	.	91	553	1624
2010	948	110	40	.	118	446	1662
2011	971	125	50	.	150	383	1679
2012	979	133	50	.	180	353	1695
2013	978	144	59	.	200	332	1713
2014	985	154	65	.	227	293	1724
2015	988	172	65	.	242	269	1736
2016	992	184	66	.	256	268	1766
2017	1008	198	66	.	253	276	1801
2018	1009	216	66	3	259	253	1806

\*FWP's database is dynamic and the status of a lek can change retroactively based on new information entered at any time. Reviewers may notice small changes in classification numbers from what was reported in the 2017 report. These are not errors; rather they are the most up-to-date numbers as of this report.

^New status created in 2018. See definition below.

## Lek Status Definitions

*Confirmed Active* - Data supports existence of lek. Supporting data defined as 1 year with 2 or more males lekking on followed by evidence of lekking (Birds - male, female or unclassified; -OR- Sign - vegetation trampling, feathers, or droppings) within 10 years of that observation.

*Confirmed Inactive* - A Confirmed Active lek with no evidence of lekking (Birds - male, female or unclassified; -OR- Sign - vegetation trampling, feathers, or droppings) for the last 10 years. Requires a minimum of 3 survey years with no evidence of lekking during a 10 year period. Reinstating Confirmed Active status requires meeting the supporting data requirements.

*Confirmed Extirpated* - Habitat changes have caused birds to permanently abandon a lek (e.g., plowing, urban development, overhead power line) as determined by the biologists monitoring the lek.

*Never confirmed active* – An Unconfirmed lek that was never confirmed active. Requires 3 or more survey years with no evidence of lekking (Birds - male, female or unclassified; -OR- Sign - vegetation trampling, feathers, or droppings) over any period of time.

*Provisionally Active* – Preliminary data supports existence of an active lek. This status can only apply during the first year of detection. Supporting data defined as 1 observation with 2 or more males lekking on site AND sign of lekking (vegetation trampling, feather, or droppings) or followed by a 2<sup>nd</sup> observation of 2 or more males lekking within the same survey year.

*Unconfirmed* - Possible lek. Grouse activity documented. Data insufficient to classify as Confirmed Active status.

## References

- McCaffrey, R., J.J. Nowak, and P.M. Lukacs. 2016. Improved analysis of lek count data using N-Mixture models. *Journal of Wildlife Management*; DOI: 10.1002/jwmg.21094.
- Taylor, R.L., B.L. Walker, D.E. Naugle, and L.S. Mills. 2011. Managing multiple vital rates to maximize Greater Sage-grouse population growth. *Journal of Wildlife Management*; DOI: 10.1002/jwmg.267
- Fedy, B.C. and K.E. Doherty. 2010. Population cycles are highly correlated over long time series and large spatial scales in two unrelated species: greater sage-grouse and cottontail rabbits. *Oecologia*; DOI 10.1007/s00442-010-1768-0